LAWRENCE LIVERMORE
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, Jan. 24-28, 2011

Feel the HEAF

Inside the Lab's High Explosives Application Facility.

In light of the recent terrorist bombings at the Moscow Airport, there's no better time than the present for LLNL scientists to tackle the problem.

A story recently aired on CNN takes an inside look at what investigators are doing to track down and outsmart master bombers.

CNN came to LLNL to find answers to questions raised in the wake of the Moscow bombing. Jon Maienschein of the Lab's High Explosives Application Facility, showed the crew a test of a bomb with half a pound of explosives like the kind used by terrorists. He said terrorists are have gotten more creative since 9/11.

"The explosives are frankly mixtures that I didn't really expect to work," he said. "It's been eye opening to us."

To see the full video, go here.

NIF's got sol

A polished capsule for (NIF) inertial confinement fusion experiments.

The sun: It is the star of our solar system, and it is lighting the way for scientists to re-create its same powerful force here on Earth. Scientists at the National Ignition Facility at Lawrence Livermore are moving closer to achieving fusion ignition in a laboratory setting.

NIF works by focusing 192 lasers on a target of deuterium and tritium. The power of the lasers fuses the atoms together, creating the same energy as that of the sun. Recently SETI (Search for Extraterrestrial Intelligence) radio visited NIF for its NPR-based program, "Are We Alone?" for its edition of "You've got Sol." Host Seth Shostik spoke with Mike Dunne, director of the fusion energy program at NIF.

For more on the report, see the Web.

Science that changes the world

The BBC recently aired a story on the Top 10 scientific advances of our time and the National Ignition Facility came in at No. 4

It has been 50 years since the invention of the laser and NIF plans to use the very same kind of laser (192 beams of them at 500 trillion watts to be exact) to create a clean, limitless supply of energy.

Creating nuclear fusion is no easy feat. The 192 beams of the world's most powerful laser fuses atoms together, creating the same energy as the sun. In one billionth of a second, the energy inside the atoms would be released to create 500 times more energy than is used in the entire U.S. grid.

"There's no issue of pollution and no issue of global climate warming. It is a dream," said Ed Moses, NIF director.

To see the full story, go here.

Laboratory in a briefcase

A portable nuclear magnetic resonance (NMR) device used for the detection of chemical warfare agents developed at Livermore now fits inside a briefcase. Members of the development team (from left) Lee Evans, Joana Diekman, Kristl Adams, and team lead Julie Herberg display the new device next to a laboratory-scale NMR spectrometer.

Although nuclear magnetic resonance spectroscopy is a powerful, non-destructive tool for identifying chemical structures, the analytical technique isn't mobile: It typically requires a large, expensive instrument that weighs a ton and occupies an entire laboratory.

A research team from the Laboratory's Physical and Life Sciences Directorate has revamped the technology so that it weighs a mere 9 kilograms (20 pounds) and fits inside a briefcase. The new device can be transported into the field for on-the-spot analysis of potential chemical warfare agents or other hazardous chemicals.

In the past five years, researchers have started developing small NMR instruments that collect data on chemical structures. To build these smaller, cheaper devices, scientists have relied on portable high-field magnets to produce uniform magnetic fields and on miniaturized versions of the radio-wave receivers called microcoils. Julie Herberg of Livermore and her colleagues recently developed a laser lithography technique to mass produce these microcoils.

To read more, go to the Web.

Scrub a dub

Chemically scrubbing a natural gas power plant's emissions then pumping the resulting compound into the sea could benefit marine life.

Greg Rau of the Institute of Marine Sciences at UC Santa Cruz, who also works in the Carbon Management Program at the Laboratory, conducted experiments to find out if a seawater/mineral carbonate (limestone) gas scrubber would remove enough CO2 to be effective, and whether the resulting substance -- dissolved calcium bicarbonate -- could then be stored in the ocean where it might also benefit marine life, such as corals.

In addition to affecting global warming, when CO2 is released into the atmosphere, some is taken up by the ocean, making it more acidic.

If the calcium carbonate created by the scrubbing process were released to the ocean it would add to ocean alkalinity and help buffer and offset the effects of ongoing marine acidification, according to Rau.

To read more, go to the Web.

Photo of the week

It's like shuffling cards: Livermore chemist Carlos Valdez synthesizes molecules based on the elemental structures. The process involves shuffling and arranging atoms around a metal center. Only a few of the molecules have the structural stability and ease of construction that would make them candidates for CO2 capture.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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